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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/040,017	01/04/2002	Mischa Megens	1-10-5	8821

47394 7590 12/07/2005

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EXAMINER	
ANGEBRANNDT, MARTIN J	

ART UNIT	PAPER NUMBER
1756	

DATE MAILED: 12/07/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/040,017	MEGENS ET AL.	
	Examiner	Art Unit	
	Martin J. Angebranndt	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *9/30/05*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

1. The response of the applicant has been read and given careful consideration. Responses to the arguments of the applicant are presented after the first rejection to which they are directed. Rejection of the previous office action not repeated below are withdrawn based upon the arguments of the applicant and the amendments to the claims.

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1-27 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. Components critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976).

4. It seems from the Yang et al., "Creating periodic three dimensional structures by multibeam interference of visible laser", Chem. Mater. Vol 14(7) pp. 2831-2833, that the presence of the amine neutralizer is required to eliminate background exposure. (page 2832/left column) and prevent development. The instant specification is less forthright at [0036] of the prepub. If the applicant makes the changes set forth below, the 102 rejections based upon Turberfield, "Photonic Crystals made by Holographic Lithography, MRS Bull. Pp. 632-636 (08/2001) or Campbell, et al., "Fabrication of Photonic Crystals for the Visible Spectrum by Holographic Lithography, Nature, Vol. 404. pp. 53-56 (03/2000) would be obviated.

Claims 1 and 14 do not recite either **reactive materials,** which undergo photochemical reactions resulting in refractive index changes or **neutralizer molecules**.

Claim 11 does not recited **reactive materials**, which undergo photochemical reactions resulting in refractive index changes

5. Claims 1-27 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for compositions using ionic photoinitiation, does not reasonably provide enablement for other polymerization mechanisms, such as free radical polymerization as no neutralization means or mechanisms described for that polymerization system. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to practice the invention commensurate in scope with these claims.

Claims 1 and 14 do not recite either photoreactive materials, which undergo ionic photoinitiated photochemical reactions resulting in refractive index changes or neutralizer molecules.

Claim 11 does not recited **reactive materials**, which undergo ionic photoinitiated photochemical reactions resulting in refractive index changes

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1-10,14,16,18 and 20 are rejected under 35 U.S.C. 102(a) as being fully anticipated by Turberfield, "Photonic Crystals made by Holographic Lithography, MRS Bull. Pp. 632-636 (08/2001).

Turberfield, "Photonic Crystals made by Holographic Lithography, MRS Bull. Pp. 632-636 (08/2001) teaches the use of an Epoxy based resist EPON SU8, with a triarylsulfonium salt as the photoinitiator/photoacid generator. The resist is coated on a substrate, heated to remove the solvent, exposed to four beams. "absorption of the UV photon by the molecule of PAG liberates a hydrogen ion; acid catalyzed polymerization occurs when the film is heated in a post-exposure bake". The photonic crystal structure is revealed by development using propylene glycol methylether acetate in an ultrasonic bath. (page 633, right column). The formation of full connected polymer and air void lattices is disclosed. (page 634, center column). The filling of the resultant structure with titania is disclosed. (page 635, left column). The use of three beam exposure is disclosed. (page 625, left column).

The statement that the polymerization does not occur until the post-exposure bake is held to meet the requirement that the exposure take place at a temperature at which refractive index changes do not occur. The examiner notes that room temperature is 25 degrees C and the specification describes temperatures below 65 degrees C as meeting this limitation in section [0044, prepub]. The viscosity post baking is held to meet the rubber-like phase limitation of claim 9.

The applicant describes the use of epoxy resins EPON-SU-8 in section [0039] of the prepub together with the use of photoacid generators to render the composition photosensitive. [0041-0043]. The reference does not specify any temperature during the exposure process and

therefore no heating or cooling is assumed. The examiner notes that room temperature is 25 degree C and the instant specification describes temperatures below 65 degrees C as inhibiting refractive index changes. [0044]. Therefore the exposure process of the claims is inherently met merely by the room temperature exposure of the reference. The post bake treatment is specifically described as liberating the hydrogen ions and facilitating acrid catalyzed polymerization, which is almost parroted by the language appearing in sections [0045-0048]. The argued position entirely neglects the facts presented in the instant specification, specifically relating to the use of the EPON SU-8 composition and therefore cannot be found persuasive. The examiner notes that the claims rejected under this heading do not require the neutralizer. If this is required to meet the claims limitations, then it should be recited as a component as discussed above. This would also serve to obviate this line of the rejection.

9. Claims 1-10,14,16,18 and 20 are rejected under 35 U.S.C. 102(b) as being fully anticipated by Campbell, et al., "Fabrication of Photonic Crystals for the Visible Spectrum by Holographic Lithography, Nature, Vol. 404. pp. 53-56 (03/2000).

Campbell, et al., "Fabrication of Photonic Crystals for the Visible Spectrum by Holographic Lithography, Nature, Vol. 404. pp. 53-56 (03/2000) teach the use of an Epoxy based resist EPON SU8, with a triarylsulfonium salt as the photoinitiator/photoacid generator. The resist is coated on a substrate, heated to remove the solvent, exposed to four beams. "absorption of the UV photon by the molecule of PAG liberates a hydrogen ion; acid catalyzed polymerization occurs when the film is heated in a post-exposure bake". The photonic crystal structure is revealed by development using propylene glycol methylether acetate in an ultrasonic

bath. (page 54). The formation of full connected polymer and air void lattices is disclosed. The filling of the resultant structure with titania is disclosed. (page 54,right column).

The statement that the polymerization does not occur until the post-exposure bake is held to meet the requirement that the exposure take place at a temperature at which refractive index changes do not occur. The examiner notes that room temperature is 25 degrees C and the specification describes temperatures below 65 degrees C as meeting this limitation in section [0044, prepub]. The viscosity post baking is held to meet the rubber-like phase limitation of claim 9.

The rejection stands for the reasons provided above as the same EPON SU-8 composition and onium photoacid generator is used as in Turberfield, "Photonic Crystals made by Holographic Lithography, MRS Bull. Pp. 632-636 (08/2001) and the same exposure at room temperature is assumed as no description of heating during the exposure process is described in the reference and noting that the composition does not require a neutralizer.

10. Claims 11-13 and 24-25 are rejected under 35 U.S.C. 102(b) as being fully anticipated by Kaisaki et al. WO 96/13538.

Comparative example 34 (page 31) is a mixture of epoxy resin UVR 6110, diphenyliodonium hexafluoroantimonate (a photoinitiator), camphorquinone (a sensitizer), and dimethylbenzylamine (an electron donor). The composition did not cure under exposure to 436 nm visible light alone (polymerization test methods 1 (page 21) and was not heated. The use of visible light of 400-700 nm is disclosed. (2/20-24).

Dimethylbenzyl amine is disclosed as a cationic polymerization modifier, which is known to delay the initiation of cationic polymerization. Other examples include triethylamine

and pentamethylaniline and some of these modifiers offer the additional advantage of increasing the rate of polymerization once it begins (Oxman et al. WO 99/62460, page 10/line 8- page 11/line25).

11. Claims 11-14 and 24-25 are rejected under 35 U.S.C. 102(b) as being fully anticipated by Oxman et al. WO99/62460.

Oxman et al. WO99/62460 in examples 1-21 teach a mixture of acrylates and epoxy curable materials, together with diaryliodonium hexafluoroantimonate, camphorquinone, polytetrahydrofuran together with 22 different cationic polymerization modifiers. Example 5 uses 2,4,6-pentamethylaniline, example 6 used dimethylbenzylamine, example 13 used ethanolamine and example 10 uses triethylamine and the induction periods (the difference between T_3 and T_2 (control)) were determined . (page 25-30). For examples 5,6,10 and 13, the induction period raged from 0.51-3.46 minutes depending upon the amount and polymerization modifier used. (table 1 on page 29). The exposure was in the 400-500 nm range (22/22-26). Useful sensitizers include xanthene dyes (page 12/lines 1-13). Of the cationic polymerization modifiers listed on page 10, methyldimethanolamine, dibutylamine, diethanol amine, ethylemorpholine, (methylamino)ethanol and dimethylbenzylamine also increase the rate of polymerization once it begins.

12. Claims 11-14 and 24-25 are rejected under 35 U.S.C. 102(b) as being fully anticipated by Neckers et al. '802.

See example 1 which comprises cyclohexene oxide (an epoxy), ethyl erythrosine (a xanthene dye), diaryliodonium hexafluoroantimonate and pentamethylaniline. When exposed to visible light 10 minutes are required for curing. Amines useful as coinitiators with onium salts

are disclosed. (10/47-11/18). The use of these with novolak/Novolac resins is disclosed. (11/49-65).

13. Claims 1-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over **either** Campbell, et al., "Fabrication of Photonic Crystals for the Visible Spectrum by Holographic Lithography, Nature, Vol. 404. pp. 53-56 (03/2000) **or** Turberfield, "Photonic Crystals made by Holographic Lithography, MRS Bull. Pp. 632-636 (08/2001), in view of Popovich et al. '152, Neckers et al. '802 and Oxman et al. WO99/62460

Popovich et al. '152 teaches the use of eosinand triethanol amine, fluorescein and triethanolamine, erythrosin B andf triethanol amine systems as initaiion systems extending spectral response of poykerizabnle systems into the 400 – 700 nm range. The tuse of triethylamine and other aminesas co-initiators is disclosed. (8/35-9/6). The formation of gratings using 4889 nm lasers is disclosed.

It would have been obvious to one skilled in the art to modify the compositions and processes of **either** Campbell, et al., "Fabrication of Photonic Crystals for the Visible Spectrum by Holographic Lithography, Nature, Vol. 404. pp. 53-56 (03/2000) **or** Turberfield, "Photonic Crystals made by Holographic Lithography, MRS Bull. Pp. 632-636 (08/2001) which use sulfonium salts by using dye/onium together with amine coinitators/polymerization modifiers to extend the spectral response of these compositions and control the rate and onset of polymerization as disclosed by Neckers et al. '802 and Oxman et al. WO99/62460 and to use a longer wavelength laser, such as the 488 nm output of an argon ion laser to perform the interferometric exposure as taught by Popovich et al. '152, which ahs the benefit of the laser beams being visible to the eye, which allows easy adjustment of the laser beams.

14. Claims 1-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over **either** Campbell, et al., "Fabrication of Photonic Crystals for the Visible Spectrum by Holographic Lithography, Nature, Vol. 404. pp. 53-56 (03/2000) **or** Turberfield, "Photonic Crystals made by Holographic Lithography, MRS Bull. Pp. 632-636 (08/2001), in view of Popovich et al. '152, Neckers et al. '802 and Oxman et al. WO99/62460, further in view of Cowan et al. '571.

Cowan et al. '571 teach the use of argon ion lasers and HeCd lasers (458 and 442) when forming crossed grating patterns to form 2D arrays of features.

In addition to the basis provided above, the examiner cites Cowan et al. '517 to support the position that the use of visible lasers in place of the UV lasers used in the exposure processes of **either** Campbell, et al., "Fabrication of Photonic Crystals for the Visible Spectrum by Holographic Lithography, Nature, Vol. 404. pp. 53-56 (03/2000) **or** Turberfield, "Photonic Crystals made by Holographic Lithography, MRS Bull. Pp. 632-636 (08/2001) as modified by of Popovich et al. '152, Neckers et al. '802 and Oxman et al. WO99/62460 would have been obvious and furthermore the use of visible lasers to expose resists twice to form arrays of features is old and well known in the holographic arts.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Martin J. Angebranndt whose telephone number is 571-272-1378. The examiner can normally be reached on Monday-Thursday and alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Martin J Angebranndt
Primary Examiner
Art Unit 1756

12/05/2005